The evolving role of the librarian in evidence-based medicine*

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Librarians' participation in evidence-based medicine (EBM) is rooted in past practices, most notably in clinical medical librarianship. EBM extends the librarians' role beyond identification of the literature to involvement in practicing and teaching quality filtering and critical appraisal of the literature. These activities require librarians to acquire new knowledge and develop new skills. A professional development program for librarians at the Library of the Health Sciences (LHS) at the University of Illinois at Chicago (UIC) is described. The program's goals are to increase librarians' skills and support the EBM curricular initiative at the UIC College of Medicine (COM). The unique program has been a collaborative effort of the LHS and the COM. The locally developed classes provide librarians with instruction in clinical study designs, statistical concepts, and critical appraisal of the literature. Other interventions such as an EBM round table are also described. The programs' success is measured by librarians' growing involvement in EBM medical curricula, journal clubs, and morning reports. Additionally, librarians gained competence in new skills and professional satisfaction from working collegially with COM students, residents, and faculty.

There is nothing new under the sun. Ecclesiastes I.9

A great idea changes in order to remain the same. John Henry Newman [1]

INTRODUCTION

Evidence-based medicine (EBM), defined as "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients," [2] is not a revolutionary or new idea. While McCarthy writes that evidence-based medicine was introduced in 1991 by Gordon Guyatt [3], Sackett points its philosophical origins back to mid-nineteenth century Paris [4]. Certainly some of its seeds, if not its title, were planted in the series of articles by Haynes, McKibbon et al. on keeping up with the medical literature [5–10]. Just as the concept of EBM is not new to medicine, a review of the literature shows the role of the librarian in this endeavor is not new, but rather a continually evolving process. The initiatives taken by the librarians at the Library of the Health Sciences (LHS) of the University

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of Illinois at Chicago (UIC) demonstrate one way this evolution is continuing.

LITERATURE REVIEW

In order to use current best evidence, the literature must be searched, selected, and appraised. Clinical medical librarianship (CML), as described by Lamb in 1971, was one method initiated by a librarian to meet clinical information needs better. CML librarians attended rounds to identify information needs, ran searches for information, and served as a link between medical education and the library. Cimpl, in her review of the literature of clinical medical librarianship, noted that CML services were offered "to provide information quickly to physicians and other members of the health care team; to influence the information seeking behavior of clinicians and improve their library skills; and to establish the medical librarian's role as a valid member of the health care team" [11]. Objections to CML programs included concerns that the CML librarians misunderstood questions during rounds thus providing irrelevant or unsolicited information, that their medical terminology knowledge was inadequate, and that they should not be the primary source of information [12].

Demas and Ludwig, in their study of the attitudes of medical school library directors and clinical department heads toward a CML program, also found among clinicians a concern that CML librarians be well-versed in medical terminology to understand conversations on rounds thoroughly [13]. Although the responses by medical personnel were favorable to a CML program, they reiterated that "the librarian has the expertise to access the body of knowledge; however, final judgment of relevancy should be reserved for the clinician alone" [14].

As computers became readily available and software easier to use, librarians began teaching end-user searching as a way for clinicians themselves to find the best evidence. While this approach has met with some success, not all physicians have been interested in searching for a variety of reasons. Practicing physicians have consistently cited lack of time as one reason for not searching the medical literature more often [15–18]. Haynes et al. concluded in their study of MEDLINE use in the clinical setting that "inexperienced searchers miss many relevant citations and search inefficiently" [19].

Once the medical literature has been searched, selection and appraisal of the materials presents obstacles. Williamson et al. found that 78% of practitioners reported having problems sorting out irrelevant material when using the medical literature [20]. This finding, from the medical literature, is consistent with that in the library literature [21].

Quality filtering, which requires the ability to appraise the literature critically, has been a recurrent theme in library literature. Kuller and colleagues showed in a study conducted at the University of Pittsburgh that librarians recognize and select articles as effectively as physicians, although they stress different reasons for selection. In this study, both physicians and librarians used article title, abstract, and journal title as reasons for selection, with librarians focusing more on medical subject headings and physicians stressing clinical applicability more often. Neither group cited study design as a criteria of primary importance [22].

Going beyond Kuller's reasons for judging the worth of an article, Patrick, in her selected readings related to critical appraisal of the medical literature, recognized the importance of study design, meta-analysis, and statistical tests appropriate to the type of data collected [23]. The need for objective indicators to judge quality was further stressed by Johnson et al. when they listed five objective indicators of quality to be exploited in database searching including the methodological rigor of the research design [24]. In 1990, Dorsch wrote about teaching critical appraisal skills to medical students as part of a cooperative venture between the library and the college of medicine [25]. A controlled study later showed that these students scored significantly higher on library and critical appraisal questions than their counterparts who had not had the benefit of this teaching [26].

Hospital librarians have also been concerned with the issue of quality filtering. In citing future trends for hospital librarians, Klein noted that value-added service roles, such as information filtering, should grow [27], while Michaud et al. concluded that physicians must be taught how to formulate the components of a clinical question and perform critical appraisal [28]. Giuse, in a *Bulletin of the Medical Library Association* editorial, took this idea a step further and stated that "clinical librarians should read the full text of the most pertinent articles retrieved by their searches, identify and extract the information relevant to the clinical question at hand, and write brief essays . . . describing their findings" [29].

While Giuse may be one of the latest voices to call for medical librarians to rethink their role in providing medical information, she is not alone. Anderson, in the 1989 Janet Doe Lecture, has referred to public service librarians who challenge the traditional role of librarianship. "What is being advocated, though, is renunciation of the neutral reference posture in which the librarian gathers, or points the user to, bibliographic citations or sources but does not evaluate, analyze, and synthesize them to deliver the information the user actually seeks" [30].

Nagle also called for libraries and librarians to change significantly in order to meet the challenges of the ever-changing health care environment and new technologies by stating, "Emphasis is not on finding

information but on obtaining the best information available for a given situation, to find answers to many pressing questions, and to winnow out the quality from the quantity of available information" [31].

In chronicling the evolution of health sciences librarianship, Braude concluded that health sciences librarians have arrived at their current position through flexibility and the ability to adapt to changes, an ability facilitated by their educational process. Thus, librarians have "a responsibility to continue the evolution of our education in response to changing conditions and to commit to lifelong learning in order to incorporate into our practice the best of the new" [32]. This same call for continuing education is reiterated in the Medical Library Association's (MLA) *Platform for Change.* While repeatedly noting that professionals must assume greater responsibility for directing their life-long learning, the document also states that employers should accept responsibility for providing high quality on-the-job training and placing a high priority on professional development [33].

A COOPERATIVE PROGRAM BETWEEN LIBRARY AND MEDICAL FACULTY

EBM requires the librarian to identify, select, evaluate, and synthesize literature. Traditionally responsible for only the first part of the information process, identification of the literature, EBM offers librarians the opportunity to participate fully in the information process. To do so, librarians will need to engage in a concerted effort to accept new roles and acquire new skills.

LHS recognized the need for continuing education as a first step in positioning librarians for expanded roles in an EBM environment. Impending changes to introduce an EBM focus in the medical education programs at the UIC prompted library administration to assemble a focus group composed of library and medical faculty with an interest in EBM practice and teaching principles. The group's charge was to design a professional development program for librarians and formulate strategies to facilitate and support EBM in the medical curriculum. Both library and medical faculty agreed that library participation was vital to the success of an EBM approach to education and practice. As McKibbon stated "Because clinicians who practice EBP [evidence-based practice] rely more on evidence found in the literature base than on clinical experience and pathophysiology alone, librarians play a key role in the advancement of EBP. In fact, librarians are in an ideal situation to become stronger partners in the improvement of health care" [34].

Librarians at all four sites in Chicago, Peoria, Rockford, and Urbana, have long been involved in curriculum-integrated instruction. Strong liaison programs with academic health sciences departments were in place. However, staff turnovers and a growing academic librarian residency program for new librarians found the library with a pool of librarians lacking long-term experience in health sciences librarianship and instruction. Even some veteran librarians felt uncomfortable with the new roles they were being asked to assume: teaching EBM skills, quality filtering of literature, and participating in journal clubs and morning report. Search skills of both novice librarians reared in the "end-user era" and veteran librarians of the "command language era" needed enhancement to meet the responsibility of finding the best clinical evidence. McKibbon acknowledged "Librarians need to develop and keep their search skills strong; this is a challenge as less mediated searching is being done in most libraries. Librarians also need to learn new skills in their increasing role as teachers and trainers to help clinicians identify citations and ways to find them for clinical use as evidence-based practice spreads" [35].

The focus group set into action an interdisciplinary professional program to provide librarians with a basic foundation in these skills. The objectives of the program were to: increase librarians' skill levels, increase the librarians' comfort in their new roles, integrate librarians into the College of Medicine (COM) EBM activities and curricular changes, and promote professional development. Several interventions were initiated to accomplish these objectives: a summer series of EBM professional development programs was scheduled; an EBM round table was established to which all LHS librarians, affiliated hospital librarians, and several representatives from the COM were invited; a mentoring system with particular emphasis on library residents was set in place; and formal continuing education was encouraged.

Professional development summer series for librarians

The first summer series, "Evidence Based Medicine for Health Sciences Librarians," consisted of four two-hour sessions sponsored and co-taught by LHS and the COM Department of Medical Education (DME). Appendix A lists the outline for this course. The classes covered concepts and components of EBM, advanced search techniques for applying clinical filters in MEDLINE and other databases, and specialized EBM resources and outcome products. Patient case histories from an internal medicine journal club were used as examples in the classes. This case-based format offered realistic scenarios for formulating a clinical question, applying clinical filters in the search strategy, and grading and evaluating the evidence. Specific attention was given to the identification and importance of systematic overviews and meta-analyses as publication types. MeSH headings, MEDLINE limit functions, and selected textwords were identified for

filtering the literature to answer therapy, diagnosis, etiology, and prognosis problems. This format provided opportunity for discussion and experience in the same structure used by medical students and residents in journal clubs, preparing librarians for their pending participation in these arenas. Classes were open to librarians from nearby institutions and others at UIC interested in the medical literature. Twenty people attended the classes. Class evaluations were positive and identified knowledge gaps in appraising the literature, particularly in the areas of study design and statistical methods.

In response, the LHS, the COM, and the Greater Midwest Region National Network of Libraries of Medicine (GMR) cooperatively developed a course to be held over seven weeks the following summer. MLA continuing education hours were awarded. Class materials, including scanned reading assignments, were mounted on a closed Web site, available only to class participants for the duration of the class. This fourteen-hour class, "Understanding Study Design and Statistical Concepts in Clinical Research," provided in-depth application of EBM principles in selecting and evaluating evidence from the medical literature. Appendix B lists the outline for the course. Each week a statistical concept was presented, followed by discussion based on examples drawn from the medical literature. The didactic portions of the class were taught by COM faculty with expertise in medical statistics. Library faculty led the discussion and critical appraisal of articles selected to demonstrate particular research designs and statistical methods. An overview of common research designs used in clinical literature laid the foundation in the first week. Specific statistical concepts such as confidence intervals, odds ratios, risk reduction, and number needed to treat were presented within this context. Two weeks were devoted to meta-analysis as the cornerstone of EBM outcome products. The final week included a review of EBM tools and resources including the PubMed Clinical Queries feature, Cochrane Library, and practice guidelines. Fifteen librarians participated in this course.

The MLA Professional Development Course Evaluation Form was used to evaluate the course. The class received an average evaluation of 6.53 on a scale of 1 to 7, with 7 being the highest. A follow-up questionnaire was distributed to identify remaining knowledge gaps and to plan for future programming. Several trends were evident in the participants' responses. First, the need for ongoing education and professional development was a recurrent theme. As EBM is a process of lifelong learning for health professionals, so apparently it must be for librarians. Second, the appreciation that the skills learned in the course could also be applied to promoting evidence-based library practice was viewed as important. Even librarians not engaged in public services felt they benefited because they would be able to apply the study design and statistical concepts to their own research in library management, collection development, and database development.

Other interventions

Other interventions include an EBM round table, a weekly discussion group for library residents, and formal continuing education. The round table provides a forum for discussion and shared experiences and is a catalyst to wider participation in EBM activities. Attendance by COM and library faculty fosters a two-way mentoring relationship, with faculty learning from each other. Research, education, and service ideas are freely explored and lead to new initiatives. For example, the idea for a "best evidence" database produced from clinical questions from morning report and journal club was first conceived in this group.

The weekly discussion group of academic library residents meets with LHS and DME faculty to exchange ideas for improving experiences in morning report and journal club. Attendees review search strategies or the best database for difficult to answer clinical questions from morning report. Other times, logistical suggestions—such as improving the scheduling of journal club preparation conferences between library and medical residents—are discussed. These meetings provide residents with ongoing support and evaluation from faculty in both disciplines.

Formal continuing education efforts include a variety of forums through library and other professional organizations. LHS and the GMR have cooperatively sponsored local MLA and National Library of Medicine (NLM) courses in evidence-based medicine and MEDLINE searching. LHS and DME faculty have addressed the issue of librarian involvement in EBM journal clubs and morning report in the MLA-sponsored teleconference "Evidence-Based Health Care in Action." Librarians are playing an active role in the COM's EBM Special Interest Group, designed to promote EBM principles within the COM. Librarians are also encouraged to attend EBM training courses offered at EBM and Cochrane centers. Finally, a dialogue is beginning with library science educators on how graduate schools might redesign curricula to prepare librarians for future work in EBM settings.

DISCUSSION AND FUTURE DIRECTIONS

The overall objectives of this endeavor were to institute a professional development program for librarians and to support evidenced-based initiatives in the COM curriculum. The professional development program was unique and successful from several vantage points. It was a *local* effort, supported and encouraged by the library administrator, and viewed as an integral

part of the work day. All interested librarians were encouraged to attend and/or plan the class. No one person was responsible for the preparation or success of the program and the majority of librarians chose to participate. This effort, while local in the sense that it was developed and attended by UIC librarians, was also open to librarians working in nearby institutions through which UIC residents rotate. That this effort was *administratively supported* also contributed to its success; librarians were able to devote work time both to prepare and attend class. In addition, it was a *cooperative* effort with another department within the university, the College of Medicine. This cooperation addressed the issue of deficiencies in the background of the librarians, especially in the area of statistics. The librarians were able to address this area of knowledge, without being overwhelmed, with the help of the COM faculty who presented the material in a clinically relevant way. This collaboration had the added advantage of fostering a working relationship between library and COM faculty that led to other shared projects.

Another unique aspect of the program is its *sustained* effort. Support has not ended with the completion of the formal classes. Weekly meetings held with COM faculty and those librarians most heavily involved with the EBM process are seen as a way of sustaining the goals achieved by the summer classes and facilitating new growth. An unspoken message conveyed to resident librarians is that continuing education is always to be part of their professional life. Experienced as a collegial and group effort, this continuing development is exciting and rewarding.

Feelings of competence and professional satisfaction, while not formally measured, were enhanced. Librarians became more proficient in searching and filtering the literature after they came to understand the significance of study design, levels of evidence, and statistical concepts found in the clinical literature. The intangible rewards of working with other librarians, medical residents, and COM faculty were felt to be real and significant.

Another goal, supporting EBM initiatives in the COM curriculum, also is an ongoing effort. Librarians' participation in morning report, a forum where residents and the attending physician discuss patients seen in the previous day's rounds, continues to evolve. The first year has been a series of trial and error with librarians, residents, and COM faculty struggling to find a role for the librarians that is clearly defined, supportive to the residents, and workable in the curriculum. At present, librarians assigned in teams of two (one for backup), attend morning report one day a week in pediatrics and in ambulatory care. Librarians are formally introduced to each new rotation of residents and their role is clearly explained. The librarian quickly becomes a working member of the team. A searchable question is formulated at each morning report with one or more residents assigned to search with the librarian. As they become familiar with the librarians, residents have been observed to be more likely to seek help in literature searching. Collaborative search sessions occur weekly, but librarians must be flexible because the residents' time is tightly scheduled.

Attendance at morning report exposes the librarians to medical terminology, plunges them into the same learning environment as the residents, and introduces them to complex patient histories. Hearing unfamiliar medical terminology forces librarians to learn new vocabulary to understand clinical discussions better. Seeing residents challenged to make diagnosis and treatment decisions under the various pressures of morning report increases librarians' understanding of the environment in which physicians work. Setting the question in the context of patients, with all their medical complexities, transforms the literature search from an academic exercise into one with pressing human dimensions.

The journal club—a weekly, highly structured forum where an assigned resident leads the critical appraisal of a journal article with peers and faculty—is another venue in which librarians seek to contribute. At present the librarians' roles are in evolution as they become familiar with the format and the issues addressed, such as study design, levels of evidence, and statistical concepts. The aim is that librarians will ultimately become part of the preparation session held for the resident leading the discussion. In the meantime, librarians are reinforcing and expanding their own understanding of the EBM concepts introduced in the formal statistics classes described in this paper.

The final area of curriculum involvement is with medical students. Librarians at LHS sites currently teach a class that introduces students to EBM and the search skills necessary to access information efficiently and accurately. The introduction of EBM principles early in the curriculum provides the basis for the more in-depth EBM concepts encountered later in the residency program.

LHS will continue to provide ongoing professional development opportunities and forums for discussion and evaluation. New opportunities for professional development are being explored. One unique opportunity that exists is an EBM elective in the master's degree in health professions education (MHPE) program at UIC. This semester-long course is conceived by the LHS and the DME as an avenue to coalesce the expertise of several professions to advance evidence-based practice. "Principles of Evidence-Based Health Care (EBHC) Education" is co-taught by DME and LHS faculty with adjunct appointments to the COM. Health profession educators such as physicians, nurses, pharmacists, administrators, and librarians are po-

tential audiences. This pilot program may lead to an EBHC area of specialization within the MHPE curriculum. Teaching and learning side-by-side will highlight the strengths and contributions of each professional group to the EBHC process.

CONCLUSIONS

These continuing education interventions have helped librarians develop the ability to contribute to EBM activities at UIC. Sackett describes EBM as "nothing more than a process of lifelong, self-directed learning in which caring for patients creates the need for clinically important information" [36]. Lifelong, self-directed learning for librarians rises from the need to understand, manipulate, facilitate access to, provide instruction in, evaluate, and sometimes create information knowledgebases. These interventions have positioned librarians to continue to evolve as the profession faces the next century. Slawson sees this evolution as a call for librarians to "move from library services to decision support services" [37].

The EBM initiative also provides potential new interdisciplinary research opportunities. Studies of patient outcomes, the ultimate measurement of EBM benefit, may become more feasible as integrated clinical information management systems become standard. Meanwhile, other questions remain to be answered by librarians and other educators involved in EBM. Will the introduction of interdisciplinary EBM instruction in health professions curricula produce practitioners better equipped to find and appraise evidence? Does competence in filtering and evaluating the literature contribute to more informed clinical decisions? Can librarians create easily accessible knowledgebases of best evidence that will expedite the transfer of evidence into practice?

As practitioners and teachers of EBM, librarians establish a collaborative relationship with health care professionals. This increased visibility and stature places librarians in a position to affect evidence-based patient care decisions. Accordingly, increased accountability raises the profession to a new standard of practice. The profession's tradition of life-long learning and professional development continues to enable the profession to evolve into new roles in the information process.

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APPENDIX A

Evidence-based medicine for health sciences librarians

I. Introduction to the EBM paradigm
  A. Components of EBM
  B. Outcome products
  C. Asking the clinical question you can answer
  D. Types of evidence-based information
II. Searching the literature for evidence-based information
  A. Important MEDLINE features
  B. Refinement of search strategies
  C. Clinical filters in diagnosis, etiology, therapy, and prognosis questions
  D. Finding systematic overviews/meta-analyses on MEDLINE
  E. Improving retrieval of randomized controlled trials
  F. The clinical queries search on PubMed
III. Beyond MEDLINE
  A. MEDLINE sensitivity, specificity, and precision
  B. Other important databases
IV. Using evidence to make clinical decisions
  A. Evidence needed to make a good decision
    1. Probabilities of various outcomes
    2. Outcome measures (life expectancy, quality of life)
  B. Synthesizing information: decision aids

APPENDIX B

Understanding study design and statistical concepts in clinical research

Week I
Overview of common research designs used in clinical literature
Confidence intervals
Week II
Critical appraisal of article demonstrating confidence intervals
Inferential statistical tests about hypotheses; null hypothesis
Intention to treat principle
Week III
Critical appraisal of article demonstrating hypotheses tests and intention to treat principle
Risk, relative risk, relative risk reduction
Number needed to treat
Odds ratio
Week IV
Critical appraisal of article demonstrating relative risk, odds ratios, risk reduction, and number needed to treat
Disease process
Univariate and multivariate analysis
Week V
Critical appraisal of article demonstrating disease process
Meta-analysis
Week VI
Critical appraisal of meta-analysis examples
Week VII
EBM sources/tools